

WHAT IS CLAIMED IS:

1. An I.V. flush syringe assembly comprising:
  - a barrel including a cylindrical side wall having an inside surface defining a chamber for retaining fluid, an open proximal end and a distal end including a distal wall with an elongate tip extending distally therefrom having a passageway therethrough in fluid communication with said chamber;
  - a plunger including an elongate body portion having a proximal end, a distal end and a stopper slidably positioned in fluid-tight engagement with said inside surface of said barrel for drawing fluid into and driving fluid out of said chamber by movement of said stopper relative to said barrel, said elongate body portion extending outwardly from said open proximal end of said barrel; and
  - anti-reflux means for controlling stopper deflection when fluid has been delivered from said chamber and said stopper is in contact with said distal wall.
2. The syringe assembly of claim 1 wherein said anti-reflux means includes said stopper having a conically shaped distal surface and said inside surface of said barrel at said distal wall being conically shaped wherein said total included angle of said inside surface of said barrel at said distal wall is greater than said total included angle of said stopper distal surface by at least 6°.
3. The syringe assembly of claim 2 wherein said total included angle of said stopper distal surface is about 110°.
4. The syringe assembly of claim 2 wherein the total included angle conically shaped inside surface of said distal wall of said barrel is about 120°.
5. The syringe assembly of claim 2 further including at least one projection on said distal surface of said stopper positioned mostly in the space between said distal surface and said conically shaped inside surface of said distal wall when

said distal surface of said stopper first contacts said conically shaped inside surface.

6. The syringe assembly of claim 1 including flush solution in said chamber.

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7. The syringe assembly of claim 6 further including a tip cap releasably connected to said tip of said syringe barrel for sealing said passageway.

8. The syringe assembly of claim 6 wherein said flush solution is selected from the group consisting of saline flush solution and heparin lock flush solution.

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9. The syringe assembly of claim 1 wherein said stopper is made of material selected from the list consisting of thermoplastic elastomers, natural rubber, synthetic rubber, thermoplastic materials and combinations thereof.

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10. The syringe assembly of claim 1 further comprising a needle assembly including a cannula having a proximal end, a distal end and a lumen therethrough, and a hub having an open proximal end containing a cavity and a distal end attached to said proximal end of said cannula so that said lumen is in fluid communication with said cavity, said needle assembly being removably attached to said tip of said barrel through engagement of said tip to said cavity so that said lumen is in fluid communication with said chamber.

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11. An I.V. flush syringe assembly comprising:

a barrel including a cylindrical side wall having an inside surface defining a chamber for retaining fluid, an open proximal end and a distal end including a distal wall with an elongate tip extending distally therefrom having a passageway therethrough in fluid communication with said chamber;

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a plunger including an elongate body portion having a proximal end, a distal end and a stopper slidably positioned in fluid-tight engagement with said

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inside surface of said barrel for drawing fluid into and driving fluid out of said chamber by movement of said stopper relative to said barrel, said elongate body portion extending outwardly from said open proximal end of said barrel; and

5 a tip cap releasably connected to said tip of said syringe barrel for sealing said passageway;

a quantity of flush solution in said chamber between said stopper and said distal wall;

anti-reflux means for controlling stopper deflection when fluid has been delivered from said chamber and said stopper is in contact with said distal wall, 10 said anti-reflux means including said stopper having a conically shaped distal surface and said inside surface of said barrel at said distal wall being conically shaped wherein said total included angle of said inside surface of said barrel at said distal wall being greater than the total included angle of said distal surface of said stopper by at least 6°; and

15 at least one projection on said distal surface of said stopper positioned mostly in the space between said distal surface and said conically shaped inside surface of said distal wall when said distal surface first contacts said conically shaped inside surface.

20 12. A method of flushing a catheter comprising the steps of:

(a) providing a syringe assembly having a barrel including a cylindrical side wall having an inside surface defining a chamber for retaining fluid, an open proximal end and a distal end including a distal wall with an elongate tip extending distally therefrom having a passageway therethrough in fluid 25 communication with said chamber, a plunger including an elongate body portion having a proximal end, a distal end, and a stopper slidably positioned in fluid-tight engagement with said inside surface of said barrel for drawing fluid into and driving fluid out of said chamber by movement of said stopper relative to said barrel, said elongate body portion extending outwardly from said open proximal end of said barrel, a quantity of flush solution in said chamber, and anti-reflux 30

means for controlling stopper deflection when said flush solution has been delivered from said chamber and said stopper is in contact with said distal wall;

(b) providing a catheter having a proximal end, a distal end a passageway therethrough and a housing having a hollow interior connected to said catheter and in fluid communication with said passageway, said housing  
5 having an access valve for allowing fluid communication with said hollow interior;

(c) placing said distal end of said catheter in a blood vessel;

(d) engaging said elongate tip of said barrel with said access valve so that said passageway of said syringe barrel is in fluid communication with said  
10 hollow interior of said housing;

(e) applying force to said plunger to move said plunger in a distal direction with respect to said barrel so that said flush solution in said chamber flows through said passageway into said hollow chamber of said housing and through said passageway of said catheter;

(f) continue applying force to the plunger until said stopper contacts and presses against said distal wall of said barrel; and  
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(g) disengaging said elongate tip from said access valve.

13. A method of flushing a catheter comprising the steps of:

(a) providing a syringe assembly having a barrel including a cylindrical  
20 sidewall including an inside surface defining a chamber for retaining fluid, an open proximal end and a distal end including a distal wall with an elongate tip extending distally therefrom having a passageway therethrough in fluid communication with said chamber, a plunger including an elongate body portion  
25 having a proximal end, a distal end, and a stopper slidably positioned in fluid-tight engagement with said inside surface of said barrel for drawing fluid into and driving fluid out of said chamber by movement of the stopper relative to said barrel, said elongate body portion extending outwardly from said open proximal end of said barrel, a quantity of flush solution in said chamber, a needle  
30 assembly including a cannula having a proximal end, a distal end and a lumen

therethrough and a hub having an open proximal end containing a cavity and a distal end attached to said proximal end of said cannula so that said lumen is in fluid communication with said cavity, said needle assembly being attached to said tip of said barrel so that said lumen is in fluid communication with said chamber, and anti-reflux means for controlling stopper deflection when said flush solution has been delivered from said chamber and said stopper is in contact with said distal wall;

(b) providing a catheter having a proximal end, a distal end and a passageway therethrough and a housing having a hollow interior connected to said catheter and in fluid communication with said passageway, said housing having a septum for allowing fluid communication with said hollow interior;

(c) placing said distal end of said catheter in a blood vessel;

(d) forcing said distal end of said cannula through said septum so that said lumen is in fluid communication with said hollow interior of said housing;

(e) applying force to said plunger to move said plunger in a distal direction with respect to said barrel so that said flush solution in said chamber flows through said passageway into said hollow chamber of said housing and through said passageway of said catheter;

(f) continue applying force to the plunger until said stopper contacts and presses against said distal wall of said barrel; and

(g) withdrawing said cannula from said septum.